Technical Requirements for Railway Ballast in Finland

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1. INTRODUCTION

European aggregate standardisation has been going on for nearly ten years. At the moment all the test method standards are ready and accepted in all CEN-member countries. During the years 2002-03 the product standards will be in the final voting. After an 18 month transitional period all national aggregate product standards and test methods are to be withdrawn. The final date of the withdrawal will be at the end of year 2005.

Standard EN 13450 "Aggregates for railway ballast" is one of the product standards, which will be ready during the year 2002 and contains test methods which have not been used in Finland before. The Finnish railway administration has taken this into account and started a research project on the new test methods with Laboratory of Engineering Geology at Tampere University of Technology (TUT). The main objective of the project was to produce new technical requirements for railway ballast during the transitional period before EN-standard's implementation. As a result from the research project the new technical and commercial regulations have been used in Finland since December 2001. The main objective of this paper is to present shortly the regulations and the experiences got so far from the new regulations.

2. REQUIREMENTS FOR RAILWAY BALLAST

Since 1995, we have used in Finland Nordic ball mill test for abrasion resistance and Swedish impact test for resistance to fragmentation. These tests were run on ballast samples crushed in laboratory. The new method, according to EN-1097-2, for testing the resistance to fragmentation is Los Angeles test as modified for fraction 32/50 mm. Whereas the abrasion resistance will be tested with a modified Micro-deval test (EN 1097-1). The main difference between the old and new tests is the size fraction used in the test: the material used for the new methods is the unmodified railway ballast of grain size 32/63 mm whereas the old tests were run with a fraction of 8/16 mm.

The new Finnish technical requirements for railway ballast are mainly based on the EN-13450 only the Nordic ball mill test (10/16 mm) was retained for comparison reasons. The grain size distribution (EN 933-1), shape index (EN 933-4) and amount of > 100 mm grains are used for evaluation of geometrical properties of railway ballast. In the main tracks the grain size distribution class F (EN 13450) is used (Fig 1). Geometrical properties are tested in every working shift. Los Angeles test is used for evaluation of resistance to fragmentation. Physical properties are tested after every 15000 ton of production. The Micro-deval and flakiness index tests are obligatory at

certain intervals (after every 45 000 ton produced) during the production although the results are not used in classifying. These test results will give the information needed in the future when Finnish Micro-deval and flakiness index limit values are considered.

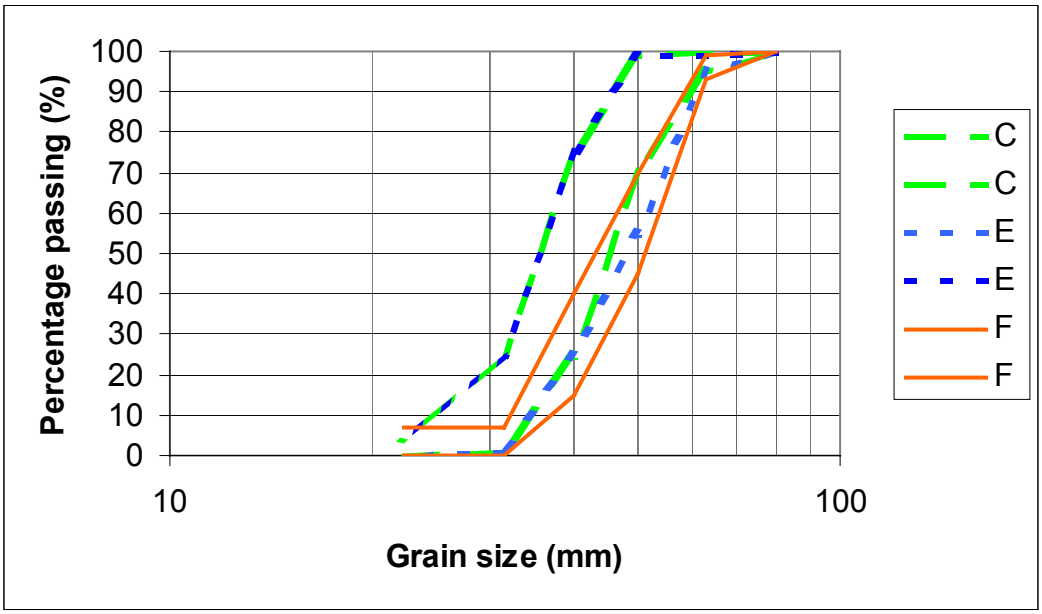

Figure 1. The grain size distribution of railway ballast used in the main tracks (F) and in lower trafficked tracks (C and E).

Table 1. The main requirements for railway ballast used in Finland

Class	Los Angeles	Nordic ball mill	Shape index	Amount of > 100 mm grains
R1/R2	≤ 12	≤ 14	≤ 20	≤ 12 %
R3	≤ 16	≤ 14	≤ 20	≤ 12 %
R4	≤ 20	≤ 14	≤ 20	≤ 12 %

As the limit value for Nordic ball mill is the same in all classes the main factor defining the ballast quality is the resistance for fragmentation.

The annual traffic in a track determines what quality class is to be selected as follows: R1/R2 in tracks where the annual traffic is ≥ 9 Million Gross Tons, R3 when the traffic is > 3 MGtn or < 9 MGtn and R4 when traffic is ≤ 3 MGtn. The selection of ballast in different tracks is based on life cycle evaluation (Nurmikolu et. al 2001).

3. RESULTS

Table 2 shows a selection of test results. The tests are done during the spring and summer 2002. The results written in ***Bold Italic*** are from ballast samples which have been produced during year 2001 and the rest are results from this year's production. The old quality classification had four classes (R1...R4).

Table 2. Test results of railway ballast according to old and new test methods

Material	Los Angeles (32/63 mm)	Nordic ball mill (10/16 mm)	Micro-deval (32/63 mm)	Class Old methods	Class New methods
1	***13***	***9,8***	***7,2***	***R2***	***R3***
2	***13***	***8,9***	***7,1***	***R2***	***R3***
3	***12***	***6,1***	***3,5***	***R1***	***R1/R2***
4	***12***	***11,8***	***8,6***	***R2***	***R1/R2***
5	***16***	***11,3***	***7,0***	***R2***	***R3***
6	***12***	***12,7***	***10,0***	***R2***	***R1/R2***
7	***12***	***9,7***	***7,4***	***R2***	***R1/R2***
8	***12***	***9,0***	***6,6***	***R2***	***R1/R2***
9	***9***	***10,1***	***6,9***	***R2***	***R1/R2***
10	11	12,5	10,1	R2	R1/R2
11	15	10,9	7	R4	R3
12	12	11	8,4	R1	R1/R2
13	9	7,5	5,1	R1	R1/R2
14	14	10,2	6,4	R4	R3
15	***14***	***20***	***NA***	***No class***	***No class***

The test results got so far are indicating that some ballast earlier classified in the first class are now in R3 due to Los Angeles coefficient. There is also an indication that some materials earlier in the lowest class get a better quality class with the new methods. Anyhow the changes in the classes can be considered small according to these test results. The Nordic ball mill value is not effecting on class changes, the class determining test is Los Angeles.

4. CONCLUSIONS

According to the experience of first production season the new technical requirements have not shown any big problems in classification of ballast. In the future when Micro-deval test shall be used to evaluation of abrasion resistance the classification will be reformed.

5. REFERENCES

EN 13450 Final draft “Aggregates for railway ballast”

Nurmikolu A.,Kuula-Väisänen P., Uusinoka R., Niskanen P., Effects of aggregate strength on the life cycle of railway ballast, Proceedings of Aggregate 2001 – Environment and Economy vol 2, Tampere 2001

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